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Temperature Effect of Concrete Strength Property Mixing with Waste Aluminum Drink Can

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Abstract

Concrete property can not be defined only by compressive and tensile strength, but temperature property of concrete is one of the most important factors under the condition of various limitation. Therefore it is considered to find out any change of concrete strength property due to temperature such as heat.

1) Aluminum materials are not effective to improve concrete strength than normal one.
2) Strength of molds heated with three hundreds degree was ten percent decreased in comparison with normal one, thirty five percent decrease for six hundreds degree, and eighty five percent decrease for nine hundreds degree centigrade.
3) Strength of molds mixed with aluminum material was fifteen percent decreased for one percent mixing proportion. Thirty percent decrease for one point five percent mixing proportion, forty five percent for two percent proportion, eighty percent for five proportion.

1. Introduction

Concrete-composing material can be taken more easily and economically. It becomes more widely used due to more largely scaled, more multi-used, more luxurious building pattern. This study is based on the idea to improve concrete strength mixing with drink can aluminum.

In presence, much more effort to re-use this waste drink can yearly increased has been taken by the Government. But, up to now, there are many drink can just wasted, causing environmental contamination and also causing much more cost to be disposed later. Drink can-reusing ideas can be a lot but materiality two kinds such as aluminum and steel can can be considered.

Only aluminum drink can can of two kinds is used for the study. Fire temperature for same materials of same building is different. Therefore, building structure temperature at fire.

This study is not find not concrete strength property, varying with temperatur-e

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change of 300℃, 600℃, 900℃, for one hour each, and to compare concrete property with normal one. Generally, the more the concrete gets heat, its strength and elastic modulus becomes less. This is a reason why each element of concrete material has the heat property. The change is not sample but mainly, it is cause due to shrinkage of cement paste and expansion of aggregate coming from water evapor-ation inside concrete. Concrete property can not be defined only by compressive and tensile strength, but temperature property of concrete is one of the most important factors under the condition of various limitation. Therefore it is consider-ed to find out any change of concrete strength property due to temperature such as heat. Concrete property mixed with aluminum drink can can be considered to design concrete building structure.

2. Test

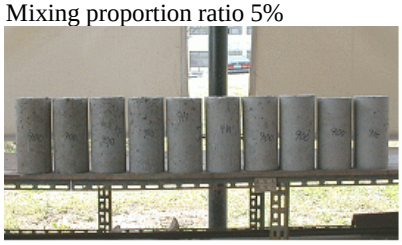
2.1 Mixture of material

Waste aluminum drink can was mixed to concrete after pressing and crashing it. Material mixture can be different from concrete kind mixing design but prompt and homogenous condition to be ensures was primarily considered. Each size of mixed aluminum drink can is a range of 0.5mm~10mm and its concrete was remixed after pouring it on the steel sheet for that each materials are not segregated. Aluminum-can mixing proportion at the test is six factors of 1%, 1.5%, 2%, 5% and 10%. And temperature conditions are three factors of 300℃, 600℃, 900℃ with gas furnace. These are shown on Table1.

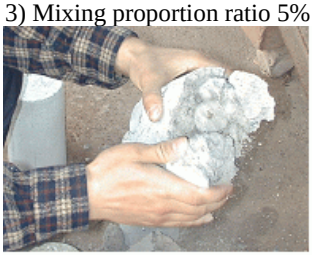
2.2 Strength Test

All test molds were made at a ready mixed concrete co. ‘D’, for getting exact results. Stripping form of those was done after 40 hours from setting concrete into the molds, keeping proper moisture with temperature 21±2℃ for curing those. Concrete compressive strength test was made in accordance with KS F 2505, “Compressive Strength Test Method”.
Three for factory and two for each temp-erature factor. Heating to these molds was given in gas furnace, installed at departm-ent of Fine Arts, Seoul National University of Technology. Firs, aluminum mixed molds without temperature change were tested for compressive and tensile strength test. And then, compressive strength test for temperature factors was done.


(1) Compressive test
(2) Mixing proportion ratio 5%



3) Mixing proportion ratio 5%



4) Fracture at 900℃ heated

Fig1. Testing mold

3. Test Results

NO.	Mixing Design	Aggerate	Cement	Sand	Water	At 28day age		Fire resistance at 28day age		
	Φ10×20 ㎝ Cylinder for three	10.95kg	3.1kg	8.95kg	2.0ℓ	compressive	split tensile	300℃	600℃	900℃
						3	3	2	2	2
①	Normal (without aluminum can)	10.95×5 =54.75kg	3.1×5 =15.5kg	8.95×5 =44.75kg	2.0×5 =10ℓ	287	40	252.6	184.5	75.5
						282	41	246.3	179.7	74.3
						285	34			
						Avg.	**284.6**	**38**	**249.5**	**182**	**74.9**
②	Mix Design					224	34	172.8	108	51.3

	1.0% by vol (for three)					219	33	175.6	111.4	54.2
						217	30			
					Avg.	**220**	**32**	**174.2**	**109.7**	**52.8**
③	Mix Design 1.5% by vol (for three)					183	28	117.3	76.3	43.9
						186	29	124.9	80.4	46.7
						178	27			
					Avg.	**182**	**28**	**121.1**	**78.4**	**45.3**
④	Mix Design 2.0% by vol (for three)					142	27	80.4	42.9	28.1
						147	19	83.1	46.1	31.4
						150	24			
					Avg.	**146**	**23**	**81.8**	**44.5**	**29.8**
⑤	Mix Design 5% by vol (for three)					92	30	13.1	9.4	5.3
						96	19	14.5	8.9	6.2
						89	17			
					Avg.	**92.3**	**19**	**13.8**	**9.15**	**5.8**
⑥	Mix Design 10% by vol (for three)					**not possible to make a mold**				
					Avg.					

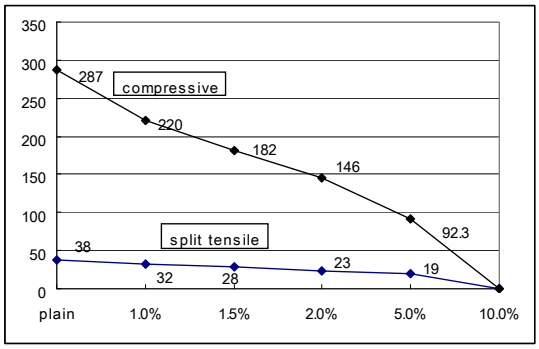
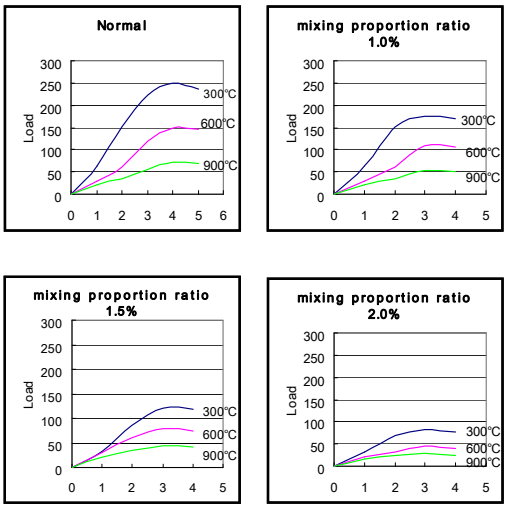


Fig2. Relation of load and aluminum material proportion



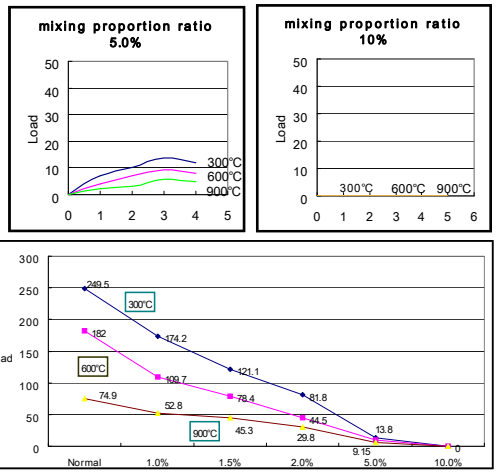


Fig3. Aluminum material-mixing proportion ratio due to temperature change

Fig4. Concrete mold shape due to temperature change

4. Analysis

1) Concrete hydration was not set satisfactorily due to in test piece, slump a little more, air content much increased.

2) Aluminum material was not satisfactorily mixed and congregated in the upper level due to its light gravity.

3) Weight of aluminum drink can mixing concrete was much lighter than the normal concrete without it.

4) Molds mixed with aluminum materials 2.0 percent were just fractured down with only a little force.

5) Mold color turned thin pink and was much cracked.

6) Mold with aluminum material more than 5.0 percent could not be formed. And its strength was shown much less than the normal one, much deformed with higher temperature.

7) It is known that aluminum material-mixing mold is so weak against heat due to the low meeting point.

5. Conclusion

Front the above test analysis, some conclusion are summarized as follow

1) Aluminum materials are not effect-ive to improve concrete strength than nor-mal one.

2) Strength of molds heated with three hundreds degree was ten percent decreased in compare-son with normal one, thirty five percent decrease for six hundreds degree, and eighty five percent decrease for nine hundreds degree centigrade.

3) Strength of molds mixed with aluminum material was fifteen percent decreased for one percent mixing propor-tion. Thirty percent decrease for one point five percent mixing proportion, forty five percent for two percent proportion, eighty percent for five proportion.

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